REBUTTAL TESTIMONY
OF
RICHARD A. VOYTAS

UNION ELECTRIC COMPANY
CASE NO. EO-96-14
CASE NO. EM-96-149

Q. Please state your name and business address.

A. My name is Richard A. Voytas. My business address is 1901 Chouteau Avenue, St. Louis, Missouri 63103.

Q. What is your present position?

A. I am employed by Ameren Services Company as Supervising Engineer of the Corporate Analysis section in the Corporate Planning Department.

Q. How long have you held your position and briefly describe your responsibilities?

A. The attached Appendix A summarizes my educational background, work experience and the duties of my position.

1. Purpose of Testimony

Q. What is the purpose of your testimony in this case?

A. My testimony and schedules present the results from the Hourly Electric Load Model (HELM) which was agreed to as the methodology to be used to estimate actual and weather normalized sales by calendar months for weather sensitive rate classes and sub-classes, as set out in Attachment A to the Stipulation and Agreement dated July 12, 1997 (Case No. EM-96-149) ("Agreement").

As I discuss below, the Staff's proposed methodology completely violates the procedures set forth in the Agreement to determine rate reductions. Apparently unbeknownst to Dennis Patterson, the Staff contractually committed itself to certain weather normalization procedures in that Agreement. As I show below, the Staff's testimony with respect to weather normalization ignores those methodologies that the parties to the Agreement had determined should govern weather normalization, and simply invented their own.

But the Staff's position in this proceeding does not simply abrogate the contractual commitments under the Agreement. The methodology proposed by the Staff is riddled with erroneous assumptions and technical flaws. Many of these flaws are so obvious that they are apparent to a layperson, much less to anyone even marginally competent in the field of climatology. To note one egregious example at the outset, the testimony submitted by the Staff's outside expert – Steven Hu – argues for a retroactive change in weather history by using data from weather stations that did not even exist during the full period for which he makes such revisions. Moreover, the testimony Mr. Hu submitted is completely unsupported by the work he actually did.

2. Weather Normalization

Q. What is weather normalization?

A. Weather normalization is quite simple. The warmer it is, the more people run their air conditioners, and electricity usage goes up. Weather normalization is the process by which the Company adjusts, or "normalizes," electricity consumption and revenues to take into account the weather.

Q. Why is weather normalization important?

A: Under the Agreement, the Company is required to distribute a permanent rate reduction equal to the average of the weather-normalized credits distributed for each of the Three Sharing Periods. *See* Agreement at Attachment A, p.4. If the summers in those Sharing Periods are cooler than normal, weather normalization is the process by which sales are adjusted upward to account for the cooler than normal weather. Likewise, if the weather is warmer than normal, weather normalization is the process by which sales are adjusted downward to account for that warmer than normal weather. The Staff and the Company realized that they needed to agree to some mechanism by which the customer credits in the Sharing Periods would be "weather normalized."

Q: How did the parties agree to weather normalize customer credits?

A: In Attachment A to the Agreement, the parties provided: "For each month, the Hourly Electric Load Model (HELM) will be used to estimate actual and weather normalized sales by calendar months for [each of six listed rate sub-classes]."

3. The HELM Model

Q. Please describe HELM.

A. HELM is a widely used model developed for the Electric Power Research Institute by ICF Resources in the early 1990's. It establishes mathematical relationships, referred to as "weather response functions," between temperatures and electricity consumption, or "loads," for each rate class or sub-class. The model then adjusts the actual loads to reflect what those loads would have been had the temperature been normal.

Q. How does the HELM model use historical weather data?

A: The HELM model uses historical temperatures to develop relationships between customer demand, or load, and a given temperature. Thus, for any given temperature, the HELM model is able to predict customer sales.

Q: How much historical weather data does the HELM model use?

A: A minimum of 30 years should be used as the historical time period. Union Electric, to achieve the most accurate possible results, uses almost 70 years for its historical time period.

Q: What is the advantage of using such a long time period?

A: Over the years, the method by which temperature has been measured in the St. Louis region has changed many times. Sometimes, the temperature-reading devices are moved closer to buildings or other man-made objects, which creates a "warming bias." Sometimes, the temperature-reading devices are moved to open fields, where they are exposed to chilling breezes, thus creating a "cooling bias." Sometimes new equipment is used, which may introduce a warming or cooling bias. Using a larger database, such as 70 years, tends to even out the warming and cooling biases and arrive at true average normal temperatures. As statisticians say, the more data, the better your expected regression. Interestingly, however, the Company's 70 year temperature database produces normal temperatures that are very similar to the 30 year normal temperatures for Lambert Airport developed by the National Climate Data Center (NCDC).

Q. Please explain that last point. In his testimony, Mr. Patterson states *that one of the principal causes of the differences between the Staff and the* Company is the "selection of the years of temperature data to be used to calculate weather normals." (p.2, lines 21-22) He seems to attribute this current dispute, at

least in part, to the Staff's use of the NCDC 30-year normals, as opposed to the Company's 70-year normals. Do you agree with Mr. Patterson?

A. No, I do not. There is very little difference between the Company's 70-year normals, and NCDC's 30-year normals.

4. The Introduction of ASOS in May 1996

Q. Did a change occur in the temperature sensors used to calculate weather adjustments during the sharing periods from July 1, 1995 through June 30, 1998?

A. Yes. On May 15, 1996 the National Weather Service (NWS) commissioned a new technology referred to as the Automated Surface Observation System (ASOS) to record temperatures at Lambert Airport. In addition, the physical location of ASOS was moved approximately one mile from the location of the prior temperature recording station. The former location had been near a group of buildings; the new location is near the runways.

Q. Did the NWS notify Union Electric that ASOS was commissioned on or about May 15, 1996? If not, how did Union Electric determine that ASOS was commissioned at that time?

A. The NWS did not notify Union Electric that ASOS was commissioned on or about May 15, 1996. Rather, after using the HELM model to calculate weather normalized sales for May 1996, the growth rate over May 1995 weather normalized sales was unusually large. In addition, the Company's load research data, which we use to define the relationship between sales and temperature, showed significant deviations from historical relationships. We thoroughly analyzed the metering and billing processes to

assure that those systems did not produce erroneous data. The next item we checked was the temperature data. That investigation lead to the discovery of ASOS equipment installation at Lambert and the impact that this equipment change had on our weather normalization process.

Q. So the HELM model was accurate enough to alert you to a change cased by ASOS even before anyone had told you ASOS had been put in place?

A. Yes.

Q. Please explain the significance of the introduction of ASOS on the HELM model.

A. The Company has an extensive hourly electric demand, or load research database, for each rate class. As mentioned above, when hourly load data is graphed against temperature data, very definitive relationships between weather and load become evident, and the relationships remain relatively constant over time. These relationships, or what are called "the weather response functions," are what HELM uses to determine the adjustment to electric sales due to deviations from normal weather. In May 1996, the relationships changed in a dramatic fashion. The data clearly showed that customers began using air-conditioning at significant levels at a temperature that was roughly 2° cooler than normal. What actually happened, we determined, was that ASOS was commissioned at Lambert Airport in May 1996 and recorded temperatures were 2°F cooler than what the prior instrumentation recorded.

Q. Please explain how temperatures recorded by ASOS are input into the HELM model.

A. The ASOS instrumentation continually measures the ambient temperature and provides sample values approximately six times per minute. The averages are rounded to the nearest degree Fahrenheit and reported once each minute as the 5-minute average ambient temperature. All mid-point temperature values are rounded up (e.g. +3.5°F rounds up to +4.0°F; -3.5.°F rounds up to -3.0°F; while –3.6.°F rounds to -4.0°F). It is worth emphasizing here that this rounding process does not undermine any accuracy in the numbers being recorded. As I will discuss more fully later in this testimony, the technological limits of our temperature measurement devices, even state-of-the-art equipment like ASOS, make temperature measurement below whole degrees very speculative. ASOS itself has a margin of error of +/- 0.9°F -- that is, nearly one full degree in each direction.

Thus the way average temperatures for the day are input into HELM is that the daily minimum and maximum temperatures for the day are input as whole numbers. Average temperature is defined as the average of the minimum and maximum temperatures and is carried to one decimal place.

Q. How did Union Electric adjust temperatures to account for the temperature bias introduced by ASOS?

A. Union Electric used the methodologies presented by Al Dutcher and Ken Hubbard of the High Plains Climate Center to determine the magnitude of the temperature adjustment to be applied to post-ASOS temperatures. The analysis compared Lambert Airport recorded temperatures to four comparative weather stations within a 40-mile radius of Lambert Airport.

Q. What were the results of the analysis?

A. The analysis showed that Lambert airport temperatures were approximately 2.0°F cooler after the installation of ASOS. Consequently, the Company's solution is very simple: The average daily temperature for all temperatures reported after the installation of ASOS at Lambert Airport should be increased by 2.0°F to align the temperatures with the historical temperatures reported prior to the installation of ASOS.

5. Discussions with Staff

Q: Please describe your initial discussions with the Staff about the commissioning of ASOS.

A: In a meeting on August 1996, the Staff downplayed the significance of the ASOS change, and suggested that a warming bias had been introduced eight years earlier, in 1988, when the temperature-measuring devices at Lambert Airport had been moved. (The devices have, in fact, either been moved or changed on several occasions in the past thirty years.) The Staff then raised a totally unprecedented alternative -- realigning all the weather data for the past 38 years.

Q: What was your opinion of the Staff's proposed re-alignment of historical data?

A: It was, to put it mildly, a very ill-conceived idea. We explained to the Staff that there could be no doubt that ASOS had introduced a cooling bias. This was the only rational explanation for the higher-than-anticipated customer sales in the summer of 1996, and afterwards. The only alternative explanation was that the residents of St. Louis had suddenly become more heat-sensitive and were using their air conditioner at temperatures cooler than they ever had before.

Furthermore, Union Electric had grave concerns about the validity of several of the Staff's assumptions in its proposed re-alignment of historical data. The Staff used the average temperature from 22 weather stations to compare to Lambert Airport temperatures; however, the Staff assumed that no changes occurred in equipment, station location, time of observation or even the person or agency responsible for recording the temperature at these comparison stations. Moreover, several of the 22 stations selected by the Staff were located over 100 miles from Lambert Airport – one almost as far away as Indiana. Finally, the Staff's analysis did not account for biases between comparison stations, time of observation bias or any of the technical issues that have to be addressed in comparing weather stations. (I discuss many of the problems with re-aligning historical data later in the testimony; the topic is also treated at length in the testimony of Mr. Allen L. Dutcher.)

Q. Did you raise these concerns with the Staff?

A. Yes, we did.

Q. What was their response?

A. They seemed to acknowledge the validity of our concerns, and said that they were not actually proposing that we undertake the impossible task of realigning 38 years of weather data.

Q: After that meeting, did you and the Staff collaborate on developing an approach for adjusting for the introduction of ASOS?

A: Yes, we discussed the issue with Lena Mantle, who follows HELM issues for the Staff, in early 1996 continuing through early 1997 to determine the appropriate adjustment to account for ASOS in connection with the rate design case, Case No. EO-

96-15. We showed Ms. Mantle all our work papers, and she agreed that a going-forward 2° adjustment was appropriate.

Q. Did the Staff suggest that the ASOS adjustment was to be temporary or limited in application to the rate design case?

A. No, the Staff did not.

Q. Please comment on Mr. Patterson's statement on page 4, lines 1-2, of his direct testimony that the Company's approach to correct for the ASOS installation "was devised as a temporary measure during the Union Electric Company's rate design case, Case No. EO-96-15."

A. This is incorrect. The Company's approach was a permanent approach to resolve the ASOS issue. The Company did extensive work in discussing the ASOS issue with climatologists, meteorologists, the Midwest Climate Center, and the National Climatic Data Center. The Company scrutinized comparison stations for Lambert. The process included site visits and discussions with on-site personnel. The Company did a rigorous statistical quality control check on temperature data recorded by the comparison stations. This process eliminated estimated temperature data, "flagged" temperature data, and obvious outliers caused by human error from the temperature databases of the comparison stations.

Q: Did there come a time when the Staff ever fully accepted the Company's position?

A: In a teleconference call relating to the rate design case in February 1998, the Staff essentially acquiesced to the Company's approach to ASOS and agreed to apply a 2° post-ASOS adjustment, apparently because they could not come up with anything

they believed was more accurate. At the same time, to our surprise, they announced that they would nevertheless not follow this methodology in calculating the adjustment to sales as part of the permanent rate reduction case, even though they had no alternative to offer in that case either. Now, apparently, the Staff is relying on the analysis of Dr. Hu as their "better" alternative.

6. Dennis Patterson's Testimony

Q. Have you reviewed the testimony submitted by Dennis Patterson?

A. Yes, I have.

Q. Please give an overview of Mr. Patterson's testimony.

A. Mr. Patterson proposes a re-alignment of nearly 38 years of weather data. He relies on the work of Steven Hu, although Dr. Hu apparently analyzed the effect of only two station changes in that 38-year period. Remarkably, given that the dispute was precipitated by the introduction of ASOS in May 1996, it does not appear that Dr. Hu did *any* analysis of the bias introduced by the commissioning of this new device. On the basis of Dr. Hu's remarkably -- one might even say, appallingly -- incomplete work, Mr. Patterson edited the official weather data compiled by the National Climactic Data Center and recalculated new Lambert Airport normal temperatures. He then invented an analysis that is not mentioned anywhere in the Agreement -- that is, he fashioned *his own* normal cooling and heating degree days. On the basis of these figures, the Staff now demands that the Company make an adjustment that is flawed methodologically, executed carelessly, and has no basis in the Agreement.

Q. Mr. Patterson's testimony begins with a section entitled, "Why Corrections are Necessary." Do you agree that corrections are necessary?

A. Of course, a correction is necessary to adjust for the significant cooling bias introduced by the commissioning of ASOS in May 1996. The data being input into the HELM model was skewed and in need of correction.

Q. Please comment briefly on the corrections proposed by the Staff.

A. The Staff's proposal has multiple flaws. First, the Staff's proposal is *methodologically* flawed. The Staff recommends that the Staff re-align 38 years of historical data. As Mr. Dutcher demonstrates in his testimony, "all of the data needed to re-write nearly four decades of weather history does not exist. [Moreover,] even if all such records existed, which they emphatically do not, it would be humanly impossible to sift through that mountain of data and make the precise adjustments proposed by the Staff. It is, in short, no more possible to re-write weather history than it is to re-write history of any kind."

Second, the Staff's analysis is marred by a number of erroneous assumptions and factual errors. Again, as Mr. Dutcher writes, the Staff's analysis "falls far short of what would be necessary, assuming it were possible, to re-write nearly four decades of weather history. The Staff's analysis is, in point of fact, riddled with fundamental, glaring errors. To take just one example, the Staff purports to compare temperatures taken at Lambert Airport to temperatures taken at two other stations for the period 1960-1996. *But one of the comparison stations – St. Charles SSW – did not even exist until 1975.*" Moreover, as Mr. Dutcher notes, the other comparison station used by Dr. Hu, St. Louis WSFO, was discontinued prior to 1996. How is that site conceivably an appropriate comparison station when ASOS was not commissioned until May 1996?

Third, the Staff's proposed adjustment, even were it humanly possible and perfectly executed, nonetheless violates the Agreement. The Agreement provided a mechanism for weather-normalizing the Company's revenues. Mr. Patterson took it upon himself, however, simply to invent a new method. With all respect, the Staff seems to be unaware of the fact that when two parties sign a contract, one of those parties is not free unilaterally to change the terms.

6. Problems with Aligning Historical Data

Q. Please compare the Company's weather-normalization procedure and the Staff's.

A. The Company's approach is really very simple. We take the historical data as a given, recognize that the commissioning of ASOS introduced a bias, and, accordingly make an adjustment on a going-forward basis. In other words, we add two degrees to the readings generated by ASOS. The Staff's approach, by contrast, is to sift through nearly four decades of weather data, making however many adjustments are necessary to align millions of data points. In other words, the Staff's approach is to realign historical temperatures.

Q. **Is it possible to re-align nearly four decades of historical data?**

A. It is not. As Mr. Dutcher demonstrates in his testimony, the empirical data needed to perform the calculations to realign weather history back to 1961 so that historical temperature readings align with current temperature readings is not available or of questionable quality. As a result, such "realignments" of necessity substitute estimates for that data and produce numbers that are no more objectively reliable than the original

historical data, and indeed may be less so. This explains why the actual re-calculation of weather history is simply not an accepted approach in the climatology community.

Q. Why should the historical temperature database not be adjusted or realigned to conform to an equivalent basis as current temperatures?

A. It is an insurmountable task to go back 40 years and accurately adjust historical temperature data for every sensor change, station move, and other temperature occurrences to attempt to align historical temperatures on an equivalent basis to current temperatures. By contrast, there are straightforward techniques that quantify the difference between temperatures recorded by a new temperature sensor versus a prior temperature sensor. These techniques use high quality empirical data which contain no estimations or correction factors. Consequently, the most accurate method to put historical and current temperature data on an equivalent basis in the event of a temperature recorder change is to apply an adjustment factor to current temperature data. This, of course, is the methodology adopted by the Company and approved by the Staff in the rate design case.

Q. Please discuss further the issues related to realigning historical temperatures.

A. Besides the inherent inaccuracy in realigning weather history, another practical barrier is that it must be a never-ending process. Continual improvement in the technology by which we record temperatures is a good thing, certainly. But if you take the view, as a theoretical matter, that you should realign weather history to account for the biases that new technology may reveal, then every time there is a change at a weather station, you must adjust historical temperatures to conform to the readings of the current

temperature recording device. Considering the number of historical sensor changes and station moves at Lambert Airport, personnel changes, and other undocumented and other now-unknown changes, it is reasonable to expect that temperature sensors and station locations will continue to change in the future. Even if the time and expense of continually attempting to realign weather history would be acceptable, there are issues related as to how to realign weather history. How are comparison stations selected? How many comparison stations should be used in the analysis? How should comparison stations be compared among themselves to assure that changes have not occurred at the comparison stations? If a comparison station records temperatures in the a.m. or p.m. and Lambert Airport records temperatures at midnight, how is the time of observation difference accounted for? What type of statistical quality control techniques should be applied to comparison station temperature data to account for estimated temperatures, missing temperatures, or erroneous temperature readings caused by human error? More detailed technical issues associated with the actual calculation of temperature differences between weather stations will be discussed later in this testimony.

Q. On page 5, lines 5-7 of Mr. Patterson's testimony, he states that "Staff's approach [to adjusting historical temperatures] is based on the methodology that the National Oceanographic and Atmospheric Administration (NOAA) follows when it constructs a time series of average temperatures for the calculation of normals." Does Mr. Patterson understand the methodology used by NOAA to calculate normals?

A. Based on that statement, Mr. Patterson does not understand the methodology. As Mr. Dutcher will explain in more detail, the methodology used for the

1961-1990 normal calculations made by NCDC (and published by NOAA) for Lambert Airport is significantly different from that used by the Staff. For one significant example, NCDC does not rely on estimated data in their calculations, while Mr. Patterson does.

In addition to Mr. Dutcher's more technical analysis, a simple examination of the "cooling degree days" computed by NCDC using their normal temperatures demonstrates the error in Mr. Patterson's claim to have followed NCDC methodology. The Company compared the NCDC cooling degree days to the straight average of cooling degree days based on the daily observations taken at Lambert. Both the NCDC cooling degree days and the averages calculated by the Company were very close, demonstrating that NCDC did not make any exposure change like that advocated by Mr. Patterson.

Q. Are there other industries that rely on accurate historical temperature data? If so, how do they deal with past exposure changes to temperature recording stations?

A. The financial community has developed a product called weather derivatives. Weather derivatives are a hedge that are designed to protect revenues from deviations due to weather. Accurate historical weather is essential to sell this product. The industry is having a difficult time getting started due to the problems associated with trying to create an artificial historical dataset that captures the changes in instrumentation, location and local climate over the years. Both the National Weather Service and the National Climatic Data Center have indicated that they will not attempt to clean up any deviations in the historical dataset. This demonstrates that the key experts who actually define the baseline of historical data in this field will not undertake the type of

adjustments advocated by the Staff here because they know it is impossible to reliably alter climate history.

7. Flaws in the Staff's Analysis

Q. Leaving aside the methodological difficulties, did the Staff conduct its analysis in a competent manner?

A. No, it did not. As Mr. Dutcher writes, "the Staff purports to undertake a novel methodology that would require an intense and meticulous review of reams of data, some of which may not even exist – and then the analysis actually produced by the Staff does not undertake such a review, but rather is rife with obvious flaws and oversights."

Q. Mr. Patterson relies on the work of Steven Qi Hu. Have you reviewed Dr. Hu's testimony?

A. Yes I have. Basically, Dr. Hu reiterates the Staff's attempt to realign weather history. Let me say at the outset that due to the highly technical nature of Dr. Hu's work, Union Electric contracted with a climatologist consultant, Mr. Allen L. Dutcher, to assist in a review of Dr. Hu's testimony.

Mr. Dutcher is the Nebraska state climatologist. He co-authored the paper, relied upon by both the Staff and UE, which describes the technique referred to as double mass analysis to measure temperature bias. Mr. Dutcher has experience in dealing with the ASOS issue with other electric utilities. In addition, Mr. Dutcher works with other groups including weather derivative financial markets on ASOS-related issues.

Q. Is Mr. Dutcher the same "Dutcher" referenced in Dr. Hu's direct testimony in Schedule 1-2 as the expert stating that ASOS has been providing accurate measurement of air temperatures?

A. Yes, he is.

Q. Has Mr. Dutcher analyzed the impact of ASOS at other electric utilities?

A. Yes, he has. Mr. Dutcher conducted a study for Lincoln Electric in 1993.

Q. What were the results of that study?

A. The study concluded that a cooling bias of 1.8°F occurred after ASOS became operational.

Q. What were the results of Mr. Dutcher's review of Dr. Hu's testimony and schedules?

A. Mr. Dutcher focused on three aspects of Dr. Hu's testimony: (1) the comparison weather site selections, (2) the time of observation adjustments methodology employed by Dr. Hu and (3) data quality.

Q. Briefly explain the comparison weather site selection issues.

A. Dr. Hu compared Lambert Airport to two weather sites – the St. Louis WSFO station and the St. Charles 7 SSW station. However, the St. Louis WSFO station did not begin measurements until the early 1980s and *discontinued operations prior to 1996*. This station obviously can provide no data that is relevant to any effort to account for the ASOS change that occurred at Lambert Airport in May 1996. Similarly, the St. Charles 7 SSW station *did not begin taking temperature measurements until 1975*. Here again, how can this station be used to realign weather history back to 1961, a period of 14 years in which that station did not even exist?

In addition, the comparison stations had substantial changes during the 1961-1996 period. For example, the St. Charles 7 SSW site changed temperature sensors from a

liquid and glass thermometer to a MMTS or maximum, minimum temperature sensor. The St. Louis WSFO station site location changed from the Busch Wildlife Center to the Missouri Research Park. Consequently, Dr. Hu's analysis contains biases at least as significant, if not more so, as any that may now be in the historical data.

Q. *Briefly explain the time of observation adjustment issues associated with Dr. Hu's testimony.*

A. In his testimony, Mr. Dutcher explains why the time of observation adjustment undertaken by Dr. Hu was unnecessary. Even assuming such an adjustment was necessary, the methodology used by Dr. Hu was flawed, as Mr. Dutcher demonstrates. Once again, the Staff is introducing another minute adjustment to recorded, official weather data, following the Staff's overall approach of undermining a body of reliable, official data with the Staff's own estimates and speculation, all in the name of supposedly creating a more objective weather normalization. Needless to say, injecting the Staff's speculation into the process does not make for a more objective or reliable result.

Q. Briefly explain your concerns about the quality of the data used by Dr. Hu.

A. Standard statistical quality control techniques require that data be analyzed for reasonableness. That is what the Company did. In its comparison site selection, we removed suspect data "flagged" as questionable by NCDC, and obvious statistical outliers. There is no evidence from Dr. Hu's workpapers that he performed this elementary and essential procedure.

Moreover, Dr. Hu's analysis uses temperature databases that contain estimated temperatures. For example, at the St. Charles 7SSW Station, some of the data taken on approximately 360 days of the 1975-1995 time period *is missing*. When confronted with missing data, the Company removes that day from its double mass analysis. Dr. Hu, on the other hand, relies on estimated values for the missing data, and thereby injects another source of error into his calculations.

Q. In light of these weaknesses in Dr. Hu's analysis, please comment on the plausibility of the minute adjustments proposed by him.

A. The culmination of the artificial weather world Dr. Hu tries to construct is his proposal to make very small but allegedly precise temperature adjustments of 0.3°F in 1978 and 0.45°F in 1988. The striking fact that Dr. Hu does not tell the Commission is that the National Weather Service laboratories have determined that the ASOS temperature sensor has an accuracy of +/- 0.9 °F. Thus Dr. Hu urges adjustments to compensate for what he contends are biases in the historical record – adjustments that he claims are necessary to make weather normalization more accurate – but Dr. Hu's adjustments themselves are smaller than the inherent accuracy of the sensors that record the temperature in the first place. Put another way, the most up-to-date measurement technology we have could not measure the miniscule bias Dr. Hu contends affect the historical temperature record. That being the case, this "bias" could hardly affect the measurement of temperature or weather normalization calculations.

Here again, the speculative character of all these estimates and assumptions which form the basis for Dr. Hu's calculations is manifest. Even the National Weather Service does not record temperatures in anything smaller than whole degree numbers, recognizing

that the impression of scientific precision and accuracy that might be conveyed by trying to do so would be an illusion not reflecting the limitations on our ability to record the weather in such exquisitely fine gradations.

Q. Please summarize your views of Dr. Hu's analysis.

A. To be frank, I have been involved in many regulatory proceedings over the years, and I have *never* seen testimony so littered with mistakes as Dr. Hu's. He writes, for example, "I will explain the necessity for adjusting the station temperatures and a procedure I used in correcting the Saint Louis Lambert International Airport station temperature time series for the time period 1961-1998." (p.3, lines 1-3) However, the analysis he actually undertook was focused on only *two* station changes in that 38 year period. Dr. Hu states that that only "two of the four location changes" introduced any biases. (p.4, line 21) How could he possibly know -- given the fact that he looked at only two station changes? He states, "I found no bias from the location change in June [sic] 1996," (p.6, line 10-11) but, again, he never did any analysis whatsoever of the effect of the commissioning of ASOS.

8. The Staff's Proposal Violates the Agreement

Q. Did the Agreement outline the methodology to be followed to make temperature adjustments in the event of a change in the temperature recording instrumentation?

A. The Agreement reflected the well-established understanding of the climatology community that adjustments to the historical weather record are not scientifically valid. Likewise, the methodology adopted by the contracting parties to govern weather normalization, the HELM model, takes the historical record as a given.

Input temperatures to the HELM model are daily maximum and minimum temperatures expressed as integers, i.e., 60°F, 80°F etc. At the same time, the Agreement did contemplate, and provide a mechanism for making, changes in the weather normalization calculation. One provision recognized that changes to the model itself could be made after notice to the parties 30 days before the effective date of the change. (Report and Order, Case No. EM-96-149 (Feb. 21, 1997), Attachment 1 at 47.) Another provision recognized that changes could be made to the "data and assumptions utilized in the HELM model" without advance notice, but such changes could only be "incorporated *prospectively* from the effective date of the change." Id. at 48 (emphasis added).

To address the new problem caused by ASOS, the Company turned to methodologies developed by climatologists with expertise in analyzing temperature bias relative to historical temperatures attributable to ASOS to determine the magnitude of the temperature adjustment. These methodologies were used to address the bias caused by ASOS from the time it was introduced going forward, not to undertake the impossible – and unnecessary – task of revising decades of recorded weather history.

Q. Was the Company's approach thoroughly discussed with and approved by the Staff?

A. Yes, it was. The Agreement required the Company to use load research data for the 24 months ending September 30, 1996 to calculate the weather adjustment for sales due to normal weather for the sharing period July 1, 1997 – June 30, 1998. Since ASOS was installed in May 1996, it was imperative that both the Staff and the Company agree on the appropriate temperature adjustment to account for ASOS in order to develop accurate weather response functions for the HELM model.

What is particularly striking now is the fact that the Staff's testimony apparently does not recognize that the introduction of ASOS has any significance, much less has a cooling bias that must be adjusted, as I have described earlier. Clearly, then, ASOS played no role in the Staff's concern for biases in the historical temperature record. Indeed, Mr. Patterson admits this. (p. 5, lines 1-3.) But if those historical biases were such a significant problem irrespective of ASOS, then the Staff must have been aware of that problem at the very least when the parties negotiated the second EARP. Yet the Staff made no effort to include in the Agreement procedures for retrospective adjustment of the official data to be used in weather normalization that addressed this "problem." In short, the Staff had the knowledge and the opportunity to propose provisions in the contract that would allow the kind of revision of weather history they now urge here. The fact that they did not seek such provisions suggests that in truth the Staff did not think that the official, historical weather data posed any problem that the Agreement had to address. The contract the Staff agreed to, then, as I have described above, does not allow for the retrospective adjustment of the data record to be used in weather normalization.

Q. On page 13, lines 4-14, of his testimony, Mr. Patterson discusses corrections that the Staff made to the Company's earnings. Are those corrections consistent with the procedures specified in the Agreement?

A. No, they are not. Rather than use the output of the HELM model to determine the annual weather-normalized credit, Mr. Patterson established totally new measures, MWh per heating degree days ("HDD") for heating months and MWh per cooling degree days ("CDD") for cooling months to calculate adjustments. In fashioning his untested methodology, Mr. Patterson independently decided which months of the

sharing period should be weather normalized and which should not. Then, if the weather normalization results still did not satisfy Mr. Patterson's notion of what the results should be, he further recalculated the weather adjustment however he saw fit as he did for the month of June 1997. In addition, this methodology completely ignored the rate classes specified in the Agreement to be weather normalized and used his own independent analysis to determine the rate classes that should be weather normalized.

Q. Please explain that last point. What rate classes did the Agreement specify to be weather normalized? What rate classes did Mr. Patterson decide to ignore?

A. Attachment A, Page 1 of the Stipulation and Agreement specifies that the following classes will be weather normalized: Residential; Commercial small general ervice; Industrial small general service; Commercial large general service; Commercial small primary service; and Commercial large primary service. In his calculations, Mr. Patterson simply dismissed two of these classes in the weather normalization process he invented. In his testimony he writes, "I made no heating month corrections for either the Large Primary or Small Primary Commercial classes, since an independent analysis showed that neither class was sensitive to changes in HDD." (p. 13, lines 21-23). Mr. Patterson seems unaware of the fact that it is not up to him to decide what classes should, or should not, be weather normalized when a binding agreement prescribes which classes should be normalized.

Q. Please summarize your testimony regarding the Staff's observance of the weather normalization procedures specified in the Agreement.

A. The Company and the Staff entered into an Agreement specifying a weather normalization procedure. The Company relied on and abided by that Agreement. The Staff, however, has acted as if it is not bound by the Agreement. Without even acknowledging what it is doing, the Staff seeks to replace the procedure set forth in the Agreement with its own.

9. Company's Calculation of Weather Adjustment

Q. Have you prepared or have there been prepared under your direction and supervision schedules for presentation to the Commission in this proceeding?

A. Yes. I am sponsoring Schedule 1.

Q. What is the subject matter of Schedule 1?

A. Schedule 1 shows the sharing period sales by month for each class and sub-class. Sales are shown both on a actual and weather normalized basis.

Q. What is the significance of Schedule 1?

A. Schedule 1 shows the amount of the weather adjustment to sales applicable to Missouri Jurisdiction customers for the three sharing periods ending June 30, 1998. Schedule 1 is the basis for the determination of the rate reduction applicable to Missouri Jurisdiction customers based on the weather normalized average revenue credits referenced in the direct testimony of Gary S. Weiss.

Q. What were the total adjustments to sales to reflect normal weather for the first three sharing periods listed on Schedule 1?

A. For the first sharing period ending June 30, 1996, actual sales were 28,785,919 KWH and weather normalized sales were 27,992,395 KWH - a difference of 793,524 KWH or 2.8%. For the second sharing period ending June 30, 1997, actual sales

were 28,317,605 KWH and weather normalized sales were 28,487,001 - a difference of –169,396 KWH or –0.6%. For the third sharing period ending June 30, 1998, actual sales were 29,309,676 and weather normalized sales were 28,766,768 KWH – a difference of 542,908 KWH or 1.9%.

10. Conclusion

Q. Please summarize your comments concerning the Staff's testimony.

A. Any attempt to rewrite weather history is a daunting task. The National Climatic Data Center will not even consider doing it. The facts show that the Staff's attempt to rewrite weather history is filled with errors, faulty assumptions, technical inconsistencies, and a general lack of understanding of the myriad of issues that have to be addressed in rewriting weather history. Ultimately the Staff relies on a temperature database containing estimated temperatures of its own, adds further estimation to the estimated temperatures by making incorrect adjustments in an attempt to correct for time of observation bias and then calculates alleged precise temperature adjustments that are significantly below the accuracy of the temperature recording instrumentation. The Staff also chooses to ignore the written procedures set forth in the Agreement for determining rate reductions by picking and choosing the rate classes it wants to weather normalize and by ignoring the measures specified in the procedures to weather normalize sales.

Q. Does that complete your testimony?

A. Yes, it does.

Attachment A

QUALIFICATIONS OF RICHARD A. VOYTAS

My name is Richard A. Voytas and my business address is 1901 Chouteau Avenue, St. Louis, MO 63103. I reside in St. Louis County, Missouri.

My educational background consists of a Bachelor of Science degree in Mechanical Engineering from the University of Missouri-Rolla in 1975 and a Masters In Business Administration from St. Louis University in 1979. I am a registered professional engineer in the state of Missouri.

I was employed full time by Union Electric beginning in May of 1975. Effective with the merger of Union Electric Company and Central Illinois Public Service Company into the Ameren Corporation, I assumed employment with Ameren Services. My work experience started at Union Electric as an Assistant Engineer in the Engineering and Construction function. I worked as an Assistant Engineer from 1975 to 1977. In 1977 I was promoted to Fuel Buyer in the Supply Services Function. In 1981 I transferred to the Engineering Department at Union Electric's Rush Island Plant. In 1982 I accepted a position in the coal marketing department at Cities Service Company in Tulsa, OK. In late 1982 I left Cities Service Company and returned to Union Electric as an Engineer in the Corporate Planning Department. From 1982 through 1992 I worked as an Engineer in the Corporate Planning Department, Engineer in the Quality Improvement Department and Engineer in the Rate Engineering Department. In 1993 I was promoted to Senior Engineer. In 1995 I was promoted to Supervising Engineer in the Demand-Side Management section of Corporate Planning. In July 1998 the Resource Planning, Forecasting, Load Research and Demand-Side Management sections were combined into

one section of Corporate Planning and I was named Supervisor of that section known as the Corporate Analysis department.

My duties as Supervisor of Corporate Analysis include overseeing the preparation of the monthly unbilled and calendar sales for every rate class – both on an actual and weather normalized basis. Corporate Analysis supports the Controller's function in the calculation of monthly unbilled sales primarily due to our expertise in running the Hourly Electric Load Model (HELM) which is the tool used to calculate monthly unbilled sales.

I have submitted testimony concerning least cost planning before the Missouri Public Service Commission and the Illinois Commerce Commission.

SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

RESIDENTIAL

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	1,310,055	1,214,646	95,410	72,793	67,491	5,301
Aug-95	1,441,088	1,108,779	332,309	80,727	62,112	18,615
Sep-95	740,984	773,134	-32,150	41,088	42,871	-1,783
Oct-95	618,040	635,816	-17,774	35,295	36,310	-1,015
Nov-95	773,782	747,164	26,619	44,207	42,686	1,521
Dec-95	1,010,575	1,002,630	7,946	65,216	64,703	513
Jan-96	1,070,694	1,057,877	12,818	55,509	54,844	664
Feb-96	969,089	1,006,961	-37,872	51,748	53,770	-2,022
Mar-96	875,599	833,558	42,040	48,931	46,581	2,349
Apr-96	699,240	691,856	7,384	40,067	39,644	423
May-96	725,490	657,965	67,526	41,867	37,970	3,897
Jun-96	1,025,050	941,361	83,689	57,005	52,351	4,654
Period #1	11,259,686	10,671,747	587,945	634,453	601,333	33,117
Jul-96	1,180,513	1,282,435	-101,923	64,876	70,477	-5,601
Aug-96	1,227,958	1,137,624	90,334	68,649	63,599	5,050
Sep-96	743,999	762,455	-18,456	41,019	42,036	-1,017
Oct-96	633,981	642,408	-8,426	35,734	36,209	-475
Nov-96	820,821	773,301	47,521	46,277	43,598	2,679
Dec-96	1,013,686	1,054,747	-41,061	58,462	60,830	-2,368
Jan-97	1,138,993	1,117,647	21,346	60,644	59,508	1,137
Feb-97	897,378	956,989	-59,610	47,068	50,195	-3,127
Mar-97	768,479	838,619	-70,140	43,868	47,872	-4,004
Apr-97	695,928	681,014	14,912	39,646	38,796	850
May-97	612,950	626,422	-13,473	35,049	35,820	-770
Jun-97	893,192	871,289	21,902	50,061	48,833	1,228
Period #2	10,627,878	10,744,950	-117,074	591,353	597,773	-6,418
Jul-97	1,308,910	1,156,566	152,343	69,855	61,725	8,130
Aug-97	1,131,436	1,119,110	12,325	61,086	60,421	665
Sep-97	835,338	787,540	47,799	44,222	41,691	2,530
Oct-97	732,271	623,463	108,806	39,626	33,738	5,888
Nov-97	780,358	771,730	8,628	44,845	44,349	496
Dec-97	1,042,442	1,081,304	-38,861	56,762	58,878	-2,116
Jan-98	1,039,209	1,169,290	-130,081	56,654	63,745	-7,092
Feb-98	827,933	955,397	-127,466	46,215	53,330	-7,115
Mar-98	898,612	881,371	17,241	47,983	47,062	921
Apr-98	657,386	682,993	-25,607	36,599	38,025	-1,426
May-98	877,478	677,627	199,850	48,101	37,146	10,955
Jun-98	1,110,326	951,518	158,808	57,789	49,523	8,265
Period #3	11,241,699	10,857,909	383,785	609,737	589,633	20,101

Notes: Two degrees added to average daily temperature to compensate for ASOS installation at Lambert beginning 5/16/96)
LSRs used in analysis for periods #1 and #2 were created from load research data for 10/1/93 to 9/30/95
LSRs used in analysis for period #3 were created from load research data for 10/1/94 to 9/30/96

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SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

COMMERCIAL SMALL GENERAL SERVICE

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	294,596	283,304	11,292	23,953	23,035	918
Aug-95	317,064	276,156	40,908	26,072	22,708	3,364
Sep-95	226,218	232,513	-6,295	18,672	19,192	-520
Oct-95	226,424	228,636	-2,212	18,231	18,409	-178
Nov-95	216,843	213,331	3,512	18,263	17,967	296
Dec-95	253,898	252,846	1,052	22,574	22,480	94
Jan-96	266,664	264,526	2,138	21,159	20,990	170
Feb-96	256,997	261,413	-4,416	21,066	21,428	-362
Mar-96	256,707	250,329	6,379	20,323	19,818	505
Apr-96	211,884	212,122	-239	18,614	18,635	-21
May-96	231,355	220,684	10,671	19,153	18,270	883
Jun-96	264,692	255,103	9,589	21,684	20,898	786
Period #1	3,023,342	2,950,963	72,379	249,764	243,830	5,935
Jul-96	293,100	305,505	-12,405	22,744	23,707	-963
Aug-96	285,426	273,825	11,600	23,945	22,972	973
Sep-96	236,265	240,063	-3,798	18,499	18,797	-297
Oct-96	224,278	225,004	-726	19,132	19,194	-62
Nov-96	225,653	219,264	6,389	18,174	17,659	515
Dec-96	256,821	262,135	-5,314	21,932	22,386	-454
Jan-97	278,008	273,407	4,600	22,723	22,347	376
Feb-97	239,778	248,135	-8,356	20,127	20,828	-701
Mar-97	230,839	238,386	-7,546	19,451	20,087	-636
Apr-97	214,219	214,001	218	18,019	18,001	18
May-97	212,475	214,875	-2,400	17,497	17,694	-198
Jun-97	255,289	253,152	2,137	21,054	20,877	176
Period #2	2,952,151	2,967,752	-15,601	243,297	244,549	-1,253
Jul-97	305,385	288,864	16,521	24,849	23,505	1,344
Aug-97	287,325	286,212	1,113	22,870	22,782	89
Sep-97	248,041	240,591	7,450	19,821	19,226	595
Oct-97	232,442	217,627	14,815	19,091	17,874	1,217
Nov-97	231,810	230,748	1,062	19,443	19,353	89
Dec-97	258,203	264,655	-6,451	21,182	21,711	-529
Jan-98	262,128	280,283	-18,155	21,818	23,329	-1,511
Feb-98	223,845	243,115	-19,270	19,422	21,094	-1,672
Mar-98	252,533	247,719	4,814	21,558	21,147	411
Apr-98	219,355	222,057	-2,702	18,740	18,971	-231
May-98	246,649	215,347	31,302	20,877	18,227	2,649
Jun-98	283,443	267,021	16,422	22,907	21,580	1,327
Period #3	3,051,159	3,004,239	46,921	252,578	248,799	3,778

Notes: Two degrees added to average daily temperature to compensate for ASOS installation at Lambert beginning 5/16/96)
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SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

INDUSTRIAL SMALL GENERAL SERVICE

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	18,064	17,371	692	1,189	1,144	46
Aug-95	18,845	16,413	2,431	1,012	881	131
Sep-95	13,571	13,949	-378	736	757	-20
Oct-95	15,499	15,651	-151	1,018	1,028	-10
Nov-95	21,373	21,026	346	821	808	13
Dec-95	21,581	21,492	89	1,390	1,384	6
Jan-96	18,102	17,957	145	1,186	1,177	10
Feb-96	16,647	16,933	-286	1,290	1,312	-22
Mar-96	17,168	16,741	427	1,154	1,125	29
Apr-96	15,507	15,524	-17	987	988	-1
May-96	15,086	14,391	696	1,049	1,001	48
Jun-96	15,960	15,382	578	1,022	985	37
Period #1	207,403	202,830	4,572	12,854	12,590	267
Jul-96	16,679	17,385	-706	960	1,000	-41
Aug-96	18,154	17,416	738	1,202	1,153	49
Sep-96	13,565	13,783	-218	899	913	-14
Oct-96	16,959	17,014	-55	816	819	-3
Nov-96	22,717	22,074	643	1,038	1,008	29
Dec-96	21,726	22,175	-450	1,343	1,371	-28
Jan-97	18,493	18,187	306	1,342	1,320	22
Feb-97	15,359	15,894	-535	1,143	1,183	-40
Mar-97	15,900	16,419	-520	1,059	1,094	-35
Apr-97	14,428	14,413	15	922	921	1
May-97	14,290	14,452	-161	849	859	-10
Jun-97	15,535	15,404	130	1,108	1,099	9
Period #2	203,805	204,616	-813	12,681	12,740	-61
Jul-97	18,259	17,271	988	942	891	51
Aug-97	16,368	16,304	63	1,000	996	4
Sep-97	14,688	14,247	441	824	799	25
Oct-97	15,841	14,832	1,010	951	890	61
Nov-97	22,986	22,881	105	885	881	4
Dec-97	22,372	22,931	-559	1,247	1,278	-31
Jan-98	16,643	17,796	-1,153	1,251	1,337	-87
Feb-98	14,551	15,804	-1,253	1,134	1,231	-98
Mar-98	16,929	16,607	323	1,270	1,245	24
Apr-98	14,536	14,715	-179	870	881	-11
May-98	15,587	13,609	1,978	926	808	117
Jun-98	16,690	15,723	967	871	821	50
Period #3	205,450	202,720	2,731	12,171	12,058	109

Notes: Two degrees added to average daily temperature to compensate for ASOS installation at Lambert beginning 5/16/96)
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SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

COMMERCIAL LARGE GENERAL SERVICE

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	489,738	478,382	11,356	25,433	24,844	590
Aug-95	523,503	481,950	41,553	26,255	24,171	2,084
Sep-95	419,849	427,445	-7,597	21,690	22,083	-392
Oct-95	390,911	389,694	1,216	19,711	19,650	61
Nov-95	375,093	372,544	2,549	19,565	19,432	133
Dec-95	416,413	415,295	1,119	24,130	24,065	65
Jan-96	428,316	425,834	2,482	21,699	21,573	126
Feb-96	414,699	420,984	-6,285	21,355	21,679	-324
Mar-96	409,979	403,069	6,910	21,715	21,349	366
Apr-96	381,076	382,931	-1,855	19,705	19,801	-96
May-96	430,851	409,116	21,735	22,510	21,375	1,136
Jun-96	459,510	448,262	11,247	24,173	23,582	592
Period #1	5,139,938	5,055,506	84,430	267,941	263,604	4,341
Jul-96	493,583	505,350	-11,767	24,898	25,491	-594
Aug-96	500,060	488,316	11,743	24,977	24,391	587
Sep-96	422,647	427,644	-4,997	21,721	21,978	-257
Oct-96	398,547	396,221	2,326	19,820	19,704	116
Nov-96	395,567	390,721	4,846	18,519	18,292	227
Dec-96	428,319	433,737	-5,418	21,554	21,827	-273
Jan-97	446,943	441,143	5,800	22,349	22,059	290
Feb-97	398,214	409,884	-11,670	20,320	20,916	-596
Mar-97	397,176	406,272	-9,095	20,936	21,415	-479
Apr-97	387,421	391,570	-4,149	19,120	19,325	-205
May-97	394,399	405,219	-10,821	20,057	20,607	-550
Jun-97	454,279	451,121	3,158	22,249	22,095	155
Period #2	5,117,155	5,147,198	-30,044	256,520	258,100	-1,579
Jul-97	526,385	504,932	21,452	27,050	25,948	1,102
Aug-97	493,859	491,546	2,313	24,502	24,388	115
Sep-97	454,635	442,930	11,706	22,484	21,905	579
Oct-97	426,881	409,422	17,460	20,786	19,935	850
Nov-97	387,230	387,505	-275	19,031	19,045	-14
Dec-97	437,816	446,918	-9,102	20,898	21,333	-434
Jan-98	431,647	455,687	-24,040	21,626	22,830	-1,204
Feb-98	374,943	397,367	-22,424	19,431	20,593	-1,162
Mar-98	438,810	429,479	9,330	21,875	21,410	465
Apr-98	400,654	403,990	-3,336	19,915	20,081	-166
May-98	454,079	416,232	37,847	23,591	21,625	1,966
Jun-98	499,059	480,173	18,885	25,229	24,274	955
Period #3	5,325,998	5,266,181	59,816	266,418	263,367	3,052

Notes: Two degrees added to average daily temperature to compensate for ASOS installation at Lambert beginning 5/16/96)
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SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

COMMERCIAL SMALL PRIMARY SERVICE

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	216,372	212,264	4,108	16,043	15,739	305
Aug-95	229,091	213,720	15,371	15,452	14,415	1,037
Sep-95	187,234	190,209	-2,975	12,644	12,845	-201
Oct-95	172,132	170,904	1,228	12,271	12,183	88
Nov-95	156,954	157,220	-266	11,985	12,006	-20
Dec-95	184,885	184,165	721	13,821	13,768	54
Jan-96	179,429	178,429	1,000	13,111	13,038	73
Feb-96	176,691	174,415	2,276	12,029	11,874	155
Mar-96	178,684	177,944	740	12,494	12,442	52
Apr-96	174,352	175,339	-987	12,338	12,408	-70
May-96	202,295	193,122	9,173	14,013	13,377	635
Jun-96	207,597	204,176	3,421	15,594	15,337	257
Period #1	2,265,716	2,231,907	33,810	161,795	159,432	2,365
Jul-96	216,459	220,966	-4,507	15,418	15,739	-321
Aug-96	221,798	216,782	5,017	14,416	14,090	326
Sep-96	192,250	193,998	-1,748	13,458	13,580	-122
Oct-96	181,498	180,329	1,170	13,672	13,584	88
Nov-96	177,605	178,074	-469	13,009	13,043	-34
Dec-96	181,825	182,925	-1,100	14,183	14,269	-86
Jan-97	182,669	179,602	3,067	13,938	13,704	234
Feb-97	161,952	163,533	-1,581	12,585	12,708	-123
Mar-97	173,589	173,520	69	13,768	13,763	6
Apr-97	169,072	170,965	-1,893	12,737	12,880	-143
May-97	188,835	192,253	-3,417	13,981	14,234	-253
Jun-97	199,911	199,489	422	15,257	15,225	32
Period #2	2,247,463	2,252,436	-4,970	166,422	166,819	-396
Jul-97	227,916	220,821	7,096	16,307	15,799	508
Aug-97	217,139	216,355	784	15,689	15,633	57
Sep-97	196,812	192,609	4,202	14,464	14,156	309
Oct-97	191,362	184,219	7,144	14,335	13,800	535
Nov-97	171,367	171,367	-1	13,099	13,099	0
Dec-97	179,465	180,905	-1,440	14,017	14,129	-112
Jan-98	178,816	182,539	-3,723	14,272	14,569	-297
Feb-98	156,455	160,590	-4,135	11,657	11,965	-308
Mar-98	182,518	178,572	3,947	13,844	13,545	299
Apr-98	177,787	178,099	-312	13,065	13,088	-23
May-98	198,823	184,126	14,697	15,209	14,085	1,124
Jun-98	206,257	200,202	6,055	14,746	14,313	433
Period #3	2,284,717	2,250,404	34,314	170,704	168,181	2,525

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SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

COMMERCIAL LARGE PRIMARY SERVICE

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	84,715	83,042	1,674	0	0	0
Aug-95	86,848	81,899	4,949	0	0	0
Sep-95	74,614	75,627	-1,013	0	0	0
Oct-95	71,288	70,762	525	0	0	0
Nov-95	64,528	64,661	-133	0	0	0
Dec-95	66,991	66,914	76	0	0	0
Jan-96	65,666	65,444	223	0	0	0
Feb-96	63,744	62,953	792	0	0	0
Mar-96	66,881	66,870	11	0	0	0
Apr-96	65,985	66,291	-306	0	0	0
May-96	72,325	69,732	2,593	0	0	0
Jun-96	78,995	77,993	1,002	0	0	0
Period #1	862,580	852,188	10,393	0	0	0
Jul-96	84,591	85,884	-1,294	0	0	0
Aug-96	85,798	84,200	1,598	0	0	0
Sep-96	77,206	77,693	-488	0	0	0
Oct-96	74,345	73,853	493	0	0	0
Nov-96	67,609	67,909	-300	0	0	0
Dec-96	74,334	74,277	57	0	0	0
Jan-97	77,754	76,832	921	0	0	0
Feb-97	69,598	69,720	-122	0	0	0
Mar-97	76,193	75,948	244	0	0	0
Apr-97	74,063	74,819	-756	0	0	0
May-97	80,741	82,118	-1,377	0	0	0
Jun-97	83,808	83,683	125	0	0	0
Period #2	926,040	926,936	-899	0	0	0
Jul-97	95,744	92,856	2,887	0	0	0
Aug-97	90,554	90,310	245	0	0	0
Sep-97	83,565	82,041	1,524	0	0	0
Oct-97	80,790	78,270	2,519	0	0	0
Nov-97	71,730	72,207	-477	0	0	0
Dec-97	75,530	75,913	-383	0	0	0
Jan-98	73,681	74,125	-444	0	0	0
Feb-98	66,926	67,632	-706	0	0	0
Mar-98	75,348	73,958	1,390	0	0	0
Apr-98	73,329	73,407	-78	0	0	0
May-98	83,535	77,385	6,150	0	0	0
Jun-98	88,419	85,709	2,710	0	0	0
Period #3	959,151	943,813	15,337	0	0	0

Notes: Two degrees added to average daily temperature to compensate for ASOS installation at Lambert beginning 5/16/96)
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LSRs used in analysis for period #3 were created from load research data for 10/1/94 to 9/30/96

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SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

INDUSTRIAL LARGE GENERAL SERVICE

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	120,658	120,658	0	4,186	4,186	0
Aug-95	127,591	127,591	0	3,875	3,875	0
Sep-95	118,286	118,286	0	3,709	3,709	0
Oct-95	108,507	108,507	0	3,485	3,485	0
Nov-95	102,845	102,845	0	3,498	3,498	0
Dec-95	102,513	102,513	0	3,887	3,887	0
Jan-96	99,900	99,900	0	3,238	3,238	0
Feb-96	111,990	111,990	0	3,452	3,452	0
Mar-96	105,958	105,958	0	3,410	3,410	0
Apr-96	108,675	108,675	0	3,313	3,313	0
May-96	107,408	107,408	0	3,363	3,363	0
Jun-96	124,692	124,692	0	3,702	3,702	0
Period #1	1,339,023	1,339,023	0	43,118	43,118	0
Jul-96	123,906	123,906	0	3,462	3,462	0
Aug-96	128,558	128,558	0	3,532	3,532	0
Sep-96	115,540	115,540	0	3,279	3,279	0
Oct-96	110,392	110,392	0	3,420	3,420	0
Nov-96	105,608	105,608	0	3,429	3,429	0
Dec-96	104,831	104,831	0	3,521	3,521	0
Jan-97	101,855	101,855	0	3,391	3,391	0
Feb-97	108,988	108,988	0	3,841	3,841	0
Mar-97	103,983	103,983	0	3,287	3,287	0
Apr-97	104,628	104,628	0	3,334	3,334	0
May-97	107,141	107,141	0	3,353	3,353	0
Jun-97	118,480	118,480	0	3,603	3,603	0
Period #2	1,333,910	1,333,910	0	41,452	41,452	0
Jul-97	121,328	121,328	0	3,040	3,040	0
Aug-97	133,388	133,388	0	3,587	3,587	0
Sep-97	125,938	125,938	0	3,457	3,457	0
Oct-97	125,567	125,567	0	3,479	3,479	0
Nov-97	115,333	115,333	0	3,500	3,500	0
Dec-97	104,175	104,175	0	3,062	3,062	0
Jan-98	104,810	104,810	0	3,043	3,043	0
Feb-98	102,652	102,652	0	3,072	3,072	0
Mar-98	104,089	104,089	0	3,032	3,032	0
Apr-98	108,762	108,762	0	2,982	2,982	0
May-98	106,028	106,028	0	3,055	3,055	0
Jun-98	119,731	119,731	0	3,050	3,050	0
Period #3	1,371,801	1,371,801	0	38,359	38,359	0

Notes: Two degrees added to average daily temperature to compensate for ASOS installation at Lambert beginning 5/16/96)
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SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

INDUSTRIAL SMALL PRIMARY SERVICE

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	176,455	176,455	0	126,249	126,249	0
Aug-95	193,468	193,468	0	129,469	129,469	0
Sep-95	178,625	178,625	0	125,467	125,467	0
Oct-95	170,687	170,687	0	123,218	123,218	0
Nov-95	177,605	177,605	0	124,688	124,688	0
Dec-95	171,903	171,903	0	136,558	136,558	0
Jan-96	172,869	172,869	0	113,183	113,183	0
Feb-96	186,867	186,867	0	118,405	118,405	0
Mar-96	181,811	181,811	0	110,062	110,062	0
Apr-96	183,915	183,915	0	123,236	123,236	0
May-96	182,298	182,298	0	132,241	132,241	0
Jun-96	181,439	181,439	0	124,100	124,100	0
Period #1	2,157,942	2,157,942	0	1,486,876	1,486,876	0
Jul-96	180,132	180,132	0	123,042	123,042	0
Aug-96	189,493	189,493	0	153,538	153,538	0
Sep-96	324,877	324,877	0	132,796	132,796	0
Oct-96	177,207	177,207	0	138,071	138,071	0
Nov-96	184,851	184,851	0	137,709	137,709	0
Dec-96	174,641	174,641	0	133,353	133,353	0
Jan-97	176,526	176,526	0	138,173	138,173	0
Feb-97	186,981	186,981	0	134,324	134,324	0
Mar-97	181,833	181,833	0	124,494	124,494	0
Apr-97	188,062	188,062	0	143,139	143,139	0
May-97	192,702	192,702	0	149,638	149,638	0
Jun-97	184,674	184,674	0	137,437	137,437	0
Period #2	2,341,979	2,341,979	0	1,645,714	1,645,714	0
Jul-97	197,532	197,532	0	147,450	147,450	0
Aug-97	208,849	208,849	0	143,438	143,438	0
Sep-97	195,649	195,649	0	146,966	146,966	0
Oct-97	188,541	188,541	0	143,775	143,775	0
Nov-97	185,195	185,195	0	140,406	140,406	0
Dec-97	173,396	173,396	0	127,293	127,293	0
Jan-98	169,069	169,069	0	145,004	145,004	0
Feb-98	164,593	164,593	0	136,525	136,525	0
Mar-98	170,448	170,448	0	136,712	136,712	0
Apr-98	169,863	169,863	0	142,632	142,632	0
May-98	170,296	170,296	0	152,277	152,277	0
Jun-98	184,809	184,809	0	145,599	145,599	0
Period #3	2,178,240	2,178,240	0	1,708,077	1,708,077	0

Notes: Two degrees added to average daily temperature to compensate for ASOS installation at Lambert beginning 5/16/96)
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SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

INDUSTRIAL INTERRUPTIBLE SERVICE

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	47,887	47,887	0	60,341	60,341	0
Aug-95	45,770	45,770	0	61,507	61,507	0
Sep-95	49,249	49,249	0	73,575	73,575	0
Oct-95	50,068	50,068	0	72,194	72,194	0
Nov-95	45,760	45,760	0	67,572	67,572	0
Dec-95	51,110	51,110	0	81,344	81,344	0
Jan-96	40,261	40,261	0	74,600	74,600	0
Feb-96	31,854	31,854	0	74,825	74,825	0
Mar-96	39,922	39,922	0	79,895	79,895	0
Apr-96	45,725	45,725	0	62,424	62,424	0
May-96	52,901	52,901	0	74,018	74,018	0
Jun-96	50,234	50,234	0	72,466	72,466	0
Period #1	550,741	550,741	0	854,761	854,761	0
Jul-96	49,777	49,777	0	72,687	72,687	0
Aug-96	55,178	55,178	0	76,079	76,079	0
Sep-96	47,721	47,721	0	67,336	67,336	0
Oct-96	54,230	54,230	0	71,827	71,827	0
Nov-96	55,537	55,537	0	57,731	57,731	0
Dec-96	51,767	51,767	0	63,815	63,815	0
Jan-97	39,622	39,622	0	69,278	69,278	0
Feb-97	32,558	32,558	0	65,316	65,316	0
Mar-97	46,875	46,875	0	65,016	65,016	0
Apr-97	55,187	55,187	0	67,190	67,190	0
May-97	55,285	55,285	0	72,541	72,541	0
Jun-97	46,037	46,037	0	66,394	66,394	0
Period #2	589,774	589,774	0	815,210	815,210	0
Jul-97	53,534	53,534	0	65,966	65,966	0
Aug-97	60,367	60,367	0	73,581	73,581	0
Sep-97	50,533	50,533	0	65,057	65,057	0
Oct-97	54,497	54,497	0	65,268	65,268	0
Nov-97	51,333	51,333	0	77,021	77,021	0
Dec-97	50,821	50,821	0	70,422	70,422	0
Jan-98	43,172	43,172	0	70,117	70,117	0
Feb-98	42,726	42,726	0	62,555	62,555	0
Mar-98	30,654	30,654	0	65,736	65,736	0
Apr-98	47,127	47,127	0	63,564	63,564	0
May-98	58,665	58,665	0	65,374	65,374	0
Jun-98	47,858	47,858	0	51,988	51,988	0
Period #3	591,287	591,287	0	796,649	796,649	0

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SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

WHOLESALE

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	170,485	163,611	6,874	70	67	3
Aug-95	182,850	157,952	24,898	72	62	10
Sep-95	136,409	139,330	-2,922	68	70	-1
Oct-95	121,763	123,280	-1,518	87	88	-1
Nov-95	139,048	136,290	2,758	84	82	2
Dec-95	157,420	156,504	916	65	65	0
Jan-96	160,146	158,715	1,431	60	60	1
Feb-96	148,007	150,402	-2,395	26	26	0
Mar-96	150,216	146,264	3,952	108	105	3
Apr-96	131,038	130,717	321	69	69	0
May-96	146,363	135,945	10,418	66	61	5
Jun-96	147,995	142,135	5,860	62	59	2
Period #1	1,791,740	1,741,145	50,593	837	814	24
Jul-96	169,285	177,014	-7,731	65	68	-3
Aug-96	173,329	165,672	7,656	88	84	4
Sep-96	139,071	140,603	-1,530	59	60	-1
Oct-96	131,770	132,361	-590	86	86	0
Nov-96	142,884	138,117	4,767	72	70	2
Dec-96	160,870	164,595	-3,725	45	46	-1
Jan-97	169,572	166,766	2,805	60	59	1
Feb-97	131,464	136,720	-5,256	64	66	-3
Mar-97	146,034	153,176	-7,141	92	97	-5
Apr-97	134,939	134,092	848	71	71	0
May-97	132,684	133,958	-1,274	60	60	-1
Jun-97	146,410	144,909	1,501	61	60	1
Period #2	1,778,312	1,787,983	-9,670	823	827	-6
Jul-97	179,526	167,576	11,950	62	58	4
Aug-97	169,188	168,225	963	67	66	0
Sep-97	150,454	145,644	4,810	71	69	2
Oct-97	144,242	135,870	8,372	88	83	5
Nov-97	143,879	143,176	702	61	61	0
Dec-97	183,590	188,335	-4,746	62	64	-2
Jan-98	166,203	178,911	-12,708	65	70	-5
Feb-98	142,950	155,405	-12,456	59	64	-5
Mar-98	165,711	164,042	1,669	66	65	1
Apr-98	140,477	143,388	-2,911	60	61	-1
May-98	157,171	141,911	15,260	68	61	7
Jun-98	171,867	158,603	13,264	59	55	5
Period #3	1,915,258	1,891,086	24,169	788	777	11

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SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

COMMERCIAL DUSK TO DAWN LIGHTING

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	6,484	6,484	0	955	955	0
Aug-95	7,576	7,576	0	1,107	1,107	0
Sep-95	7,632	7,632	0	1,173	1,173	0
Oct-95	9,320	9,320	0	1,406	1,406	0
Nov-95	9,973	9,973	0	1,438	1,438	0
Dec-95	9,907	9,907	0	1,624	1,624	0
Jan-96	8,523	8,523	0	1,198	1,198	0
Feb-96	8,049	8,049	0	1,217	1,217	0
Mar-96	7,498	7,498	0	1,196	1,196	0
Apr-96	6,907	6,907	0	1,038	1,038	0
May-96	6,372	6,372	0	936	936	0
Jun-96	5,624	5,624	0	841	841	0
Period #1	93,865	93,865	0	14,129	14,129	0
Jul-96	6,462	6,462	0	963	963	0
Aug-96	7,590	7,590	0	1,149	1,149	0
Sep-96	7,752	7,752	0	1,139	1,139	0
Oct-96	9,475	9,475	0	1,412	1,412	0
Nov-96	9,819	9,819	0	1,429	1,429	0
Dec-96	9,946	9,946	0	1,492	1,492	0
Jan-97	8,462	8,462	0	1,239	1,239	0
Feb-97	7,990	7,990	0	1,193	1,193	0
Mar-97	7,738	7,738	0	1,161	1,161	0
Apr-97	6,878	6,878	0	1,028	1,028	0
May-97	6,654	6,654	0	983	983	0
Jun-97	5,610	5,610	0	968	968	0
Period #2	94,376	94,376	0	14,156	14,156	0
Jul-97	5,966	5,966	0	898	898	0
Aug-97	6,983	6,983	0	1,047	1,047	0
Sep-97	7,437	7,437	0	1,084	1,084	0
Oct-97	9,135	9,135	0	1,299	1,299	0
Nov-97	9,792	9,792	0	1,436	1,436	0
Dec-97	9,075	9,075	0	1,359	1,359	0
Jan-98	8,292	8,292	0	1,206	1,206	0
Feb-98	7,578	7,578	0	1,096	1,096	0
Mar-98	7,508	7,508	0	1,163	1,163	0
Apr-98	6,935	6,935	0	1,030	1,030	0
May-98	6,411	6,411	0	943	943	0
Jun-98	5,998	5,998	0	910	910	0
Period #3	91,110	91,110	0	13,471	13,471	0

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SHARING PERIOD SALES (Not Adjusted For Net Output - Losses)

STREET LIGHTING / PUBLIC AUTHORITIES

	Missouri			Illinois		
	Actual	Normal	Adjustment	Actual	Normal	Adjustment
Jul-95	8,631	8,631	0	1,094	1,094	0
Aug-95	9,362	9,362	0	1,182	1,182	0
Sep-95	9,903	9,903	0	1,335	1,335	0
Oct-95	10,788	10,788	0	1,447	1,447	0
Nov-95	11,496	11,496	0	1,582	1,582	0
Dec-95	12,455	12,455	0	1,828	1,828	0
Jan-96	11,026	11,026	0	1,581	1,581	0
Feb-96	10,667	10,667	0	1,456	1,456	0
Mar-96	10,258	10,258	0	1,494	1,494	0
Apr-96	9,323	9,323	0	1,193	1,193	0
May-96	8,692	8,692	0	1,159	1,159	0
Jun-96	8,381	8,381	0	1,137	1,137	0
Period #1	120,982	120,982	0	16,488	16,488	0
Jul-96	8,373	8,373	0	1,019	1,019	0
Aug-96	9,482	9,482	0	1,243	1,243	0
Sep-96	9,818	9,818	0	1,294	1,294	0
Oct-96	11,055	11,055	0	1,498	1,498	0
Nov-96	11,747	11,747	0	1,623	1,623	0
Dec-96	12,126	12,126	0	1,677	1,677	0
Jan-97	11,668	11,668	0	1,683	1,683	0
Feb-97	10,730	10,730	0	1,480	1,480	0
Mar-97	10,307	10,307	0	1,421	1,421	0
Apr-97	9,527	9,527	0	1,245	1,245	0
May-97	8,997	8,997	0	1,177	1,177	0
Jun-97	8,201	8,201	0	1,023	1,023	0
Period #2	122,031	122,031	0	16,383	16,383	0
Jul-97	8,226	8,226	0	1,095	1,095	0
Aug-97	9,179	9,179	0	1,258	1,258	0
Sep-97	9,391	9,391	0	1,228	1,228	0
Oct-97	10,822	10,822	0	1,498	1,498	0
Nov-97	12,331	12,331	0	1,689	1,689	0
Dec-97	11,330	11,330	0	1,613	1,613	0
Jan-98	11,705	11,705	0	1,731	1,731	0
Feb-98	10,454	10,454	0	1,513	1,513	0
Mar-98	10,069	10,069	0	1,364	1,364	0
Apr-98	9,573	9,573	0	1,250	1,250	0
May-98	9,033	9,033	0	1,213	1,213	0
Jun-98	8,597	8,597	0	1,004	1,004	0
Period #3	120,710	120,710	0	16,456	16,456	0

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